CLAIMS

1. A disposable, wearable, self-contained medicine dispensing device comprising
- a housing,
- means, preferably adhesive means, for attaching said housing to the skin of a user of said device,
- a cylindrical medicine container, preferably a carpule, incorporating a piston and arranged in said housing, the container having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a needle,
- a first hollow needle extending from a first end in the interior of said medicine container through said closure body to a second end,
- a catheter in fluid communication with said second end and for injection of said medicine into said user, said catheter being associated with said housing,
- a piston rod with a longitudinally extending first screw thread on the outer surface thereof and arranged for displacing said piston from said distal end to said proximal end,
- a toothed or ratchet wheel having a central aperture for receiving said piston rod and provided with a second screw thread meshing with said first screw thread such that rotation of said ratchet wheel in a first rotational direction will displace said piston towards said proximal end,
- a pivotable body, preferably a plate element, arranged pivotable around an axis adjacent said ratchet wheel and provided with a pawl for engaging the teeth of said ratchet wheel such that pivoting of said pivotable body in a second rotational direction rotates said ratchet wheel in said first rotational direction,
- a spring means adapted and arranged for applying a spring force to said pivotable body at a first point spaced from said axis for pivoting said pivotable body in said second rotational direction, and
- a battery powered actuator for rotating said pivotable body in a third rotational direction opposite said second rotational direction.

2. A dispensing device according to claim 1, wherein said actuator comprises a shape memory alloy wire.

3. A dispensing device according to claim 1 or 2, wherein said actuator comprises a shape memory thread or wire fixedly attached at one end to an electrically conducive fastening means and fixedly attached at the opposite end to said pivotable body at a second point spaced from said axis such that contraction of said shape memory wire pivots said pivotable body in said third rotational direction.

4. A dispensing device according to any of the preceding claims, wherein said spring means comprises a rod spring extending generally parallel with said cylindrical medicine container and having one end fixated against lateral movement and the opposite end abuts, attached to or integral with said first point on said pivotable body.

5. A dispensing device according to any of the preceding claims wherein said piston rod is a flexible piston rod comprising a row of elements each having a top surface and a bottom surface as well as a lateral surface, the top surface of one element being connected to the bottom surface of the adjacent element by a hinge means located and adapted to allow the two adjacent elements to pivot from a first position where at least a portion of a top surface of one element abuts a corresponding portion of the bottom surface of the adjacent element, said first position corresponding to a rectilinear, relatively stiff configuration of the piston rod, to a second position wherein said top surface of one element is spaced from said bottom surface of the adjacent element corresponding to a curved configuration of said flexible piston rod.

6. A dispensing device according to claim 5, wherein said lateral surface has a first and a second mutually opposed circular cylindrical surface portions incorporating said first screw thread for meshing with said second screw thread.

7. A dispensing device according to claim 6, wherein at least one surface portion disposed between said first and second surface portion is plane so as to allow co-operation with means to prevent rotation of the piston rod around the longitudinal axis thereof when said first screw thread on the lateral surface of said elements is engaged by said second screw thread.

8. A dispensing device according to any of the preceding claims, wherein said first point is located such relative to said axis and said spring force that the moment arm relative to said axis of said spring force increases as said pivotable body rotates in said second rotational direction.

9. A dispensing device according to any of the preceding claims, wherein said second point is located such relative to said axis and said shape memory alloy wire force that the moment arm relative to said axis of the force exerted on said pivotable body by the contraction of said shape memory wire increases as said pivotable body rotates in said third rotational direction and/or said first point is located such relative to said axis and said spring force that the moment arm relative to said axis of said spring force increases as said pivotable body rotates in said second rotational direction.

10. A dispensing device according to any of the preceding claims, wherein controlling means for controlling the operation of said actuator according to a programme are arranged in said housing.

11. A dispensing device according to any of the preceding claims, wherein said device comprises a dispensing assembly interconnected with said housing, said dispensing assembly comprising:

- a second needle for perforating the skin of said user arranged displaceable along a linear trajectory generally orthogonal to the longitudinal extent of said first hollow needle,
- a plug of a perforatable material, preferably silicone, located on said trajectory and traversed by said first hollow needle,
- a compartment arranged adjacent said plug and receiving said second end of said hollow needle, and
- a guide body having an interior guide passage aligned with and in direct fluid communication with both the lumen of said catheter and said compartment and arranged such that said interior passage and said lumen is on said trajectory.

12. A fillable, disposable, wearable, self-contained medicine dispensing device comprising

- a housing,
- attachment means, preferably adhesive attachment means, for attaching said housing to the skin of a user of said device,
- a cylindrical medicine container, preferably a carpule, incorporating a piston and arranged in said housing, the container having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a needle,
- a hollow needle extending from a first end in the interior of said medicine container through said plug to a second end outside said housing, and
- first displacement means connected to said piston and adapted for displacing said piston from said proximal end towards said distal end, and
- second displacement means comprising a battery powered actuator for displacing said piston from said distal end towards said proximal end.

13. A device according to claim 12, wherein said second displacement means comprise

- a piston rod with a longitudinally extending first screw thread on the outer surface thereof and arranged for displacing said piston from said distal end to said proximal end,
- a toothed or ratchet wheel having a central aperture for receiving said piston rod and provided with a second screw thread meshing with said first screw thread such that rotation of said ratchet wheel in a first rotational direction will displace said piston towards said proximal end,
- a pivotable body, preferably a plate element, arranged pivotable around an axis adjacent said ratchet wheel and provided with a pawl for engaging the teeth of said ratchet wheel such that pivoting of said pivotable body in a second rotational direction rotates said ratchet wheel in said first rotational direction,
- a spring means adapted and arranged for applying a spring force to said pivotable body at a first point spaced from said axis for pivoting said pivotable body in said second rotational direction, and

- an actuator for rotating said pivotable body in a third rotational direction opposite said second rotational direction.

14. A dispensing device according to claim 12 or 13, wherein said first displacement means comprise a rod attached at one end to said piston and extending through the lumen of said cylindrical container, out through said open distal end and through an aperture is said housing to the other end located outside the housing and provided with gripping means, for instance a handle.

15. A dispensing device according to claim 14, wherein said rod is releasably connected to said piston.

16. A dispensing device according to claim 14 or 15, wherein said rod comprises two releasably interconnected rods, one of which is fixedly connected to said piston, the other of which being provided with said gripping means.

17. A dispensing device according to any of the claims 14-16, wherein said rod provided with gripping means is provided with a longitudinally extending venting channel for venting air displaced by displacement of said piston from said proximal end to said distal end.

18. A dispensing device according to any of the claims 12-16, wherein a venting aperture is provided in said housing for venting air displaced by said displacement of said piston from said proximal end to said distal end, flow of water into said housing through said venting aperture being obstructed by flow obstructing means such as a one-way or non-return valve or an air permeable, liquid impermeable, hydrophobic membrane.

19. A combination of

- a fillable, disposable, wearable, self-contained medicine dispensing device comprising:
- a housing comprising first engagement means,

- attachment means, preferably adhesive attachment means, for attaching said housing to the skin of a user of said device,

- a cylindrical medicine container, preferably a carpule, incorporating a piston and arranged in said housing, the container having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a needle, and

- displacement means comprising a battery powered actuator for displacing said piston from said distal end towards said proximal end,

and

- a filling adapter comprising:

- a rectilinear channel extending through said adapter for receiving and guiding a needle of a hypodermic syringe, and

- second engagement means for releasably engaging said first engagement means of said housing with said adapter located in such an engaged position relative to said housing that said needle when extending through and guided by said channel will perforate said closure body of said carpule for allowing injection of medicine from said syringe into said carpule.

20. A combination according to claim 19, wherein said adapter is provided with locking means for locking said needle inside said channel.

21. A combination according to claim 19 or 20, wherein

- said adapter is provided with a fixedly arranged hollow venting needle extending parallel with said channel, and
- said housing is provided with a venting element made of a material that can be perforated by said venting needle,
- the location of said venting element in said housing and of said venting needle in said adapter being such that said venting needle will extend through said venting element into the interior of said housing when said adapter is in said engaged position.

22. A combination according to claim 21, wherein said venting element is constituted by an O-ring arranged around said carpule at said proximal end thereof.

23. A medicine filling adapter comprising the features of the filling adapter according to any of the claims 19-21.

24. A method of filling medicine into a fillable, disposable, wearable, self-contained medicine dispensing device comprising the following steps:
- providing a fillable, disposable, wearable, self-contained medicine dispensing device comprising:
  - a housing,
  - attachment means, preferably adhesive attachment means, for attaching said housing to the skin of a user of said device,
  - a cylindrical medicine container, preferably a carpule, incorporating a piston and arranged in said housing, the container having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a needle, and
  - displacement means comprising a battery powered actuator for displacing said piston from said distal end towards said proximal end,
- providing a hypodermic syringe containing said medicine,
- perforating said closure body with the needle of said syringe, and
- pressing said medicine into said carpule such that said piston is displaced from said proximal end towards said distal end.

25. A dispensing device according any of the claims 12-18, 19-22 or 24, wherein said actuator comprises a shape memory alloy wire.

26. A dispensing device according any of the claims 12-18, 19-22 or 24, wherein said actuator comprises a shape memory thread or wire fixedly attached at one end to an electrically conducive fastening means and fixedly attached at the opposite end to said pivotable body at a second point spaced from said axis such that contraction of said shape memory wire pivots said pivotable body in said third rotational direction.

27. A dispensing device according to any of the claims 25-26, wherein said spring means comprises a rod spring extending generally parallel with said cylindrical

medicine container and having one end fixated against lateral movement and the opposite end abuts, attached to or integral with said first point on said pivotable body.

28. A dispensing device according to any of the claims 25-27, wherein said piston rod is a flexible piston rod comprising a row of elements each having a top surface and a bottom surface as well as a lateral surface, the top surface of one element being connected to the bottom surface of the adjacent element by a hinge means located and adapted to allow the two adjacent elements to pivot from a first position where at least a portion of a top surface of one element abuts a corresponding portion of the bottom surface of the adjacent element, said first position corresponding to a rectilinear, relatively stiff configuration of the piston rod, to a second position wherein said top surface of one element is spaced from said bottom surface of the adjacent element corresponding to a curved configuration of said flexible piston rod.

29. A dispensing device according to claim 28, wherein said lateral surface has a first and a second mutually opposed circular cylindrical surface portions incorporating said first screw thread for meshing with said second screw thread.

30. A dispensing device according to claim 29, wherein at least one surface portion disposed between said first and second surface portion is plane so as to allow co-operation with means to prevent rotation of the piston rod around the longitudinal axis thereof when said first screw thread on the lateral surface of said elements is engaged by said second screw thread.

31. A dispensing device according to any of the claims 26-31, wherein said second point is located such relative to said axis and said shape memory alloy wire force that the moment arm relative to said axis of the force exerted on said pivotable body by the contraction of said shape memory wire increases as said pivotable body rotates in said third rotational direction and/or said first point is located such relative to said axis and said spring force that the moment arm relative to said axis of said

spring force increases as said pivotable body rotates in said second rotational direction.

32. A dispensing device according to any of the claims 25-31, wherein controlling means for controlling the operation of said actuator according to a programme are arranged in said housing.

33. A dispensing device according to any of the claims 25-32, wherein said device comprises a dispensing assembly interconnected with said housing, said dispensing assembly comprising:
- a second needle for perforating the skin of said user arranged displaceable along a linear trajectory generally orthogonal to the longitudinal extent of said first hollow needle,
- a plug of a perforatable material, preferably silicone, located on said trajectory and traversed by said first hollow needle,
- a compartment arranged adjacent said plug and receiving said second end of said hollow needle, and
- a guide body having an interior guide passage aligned with and in direct fluid communication with both the lumen of said catheter and said compartment and arranged such that said interior passage and said lumen is on said trajectory.

34. A disposable, wearable, self-contained medicine dispensing device comprising
- a housing having an aperture and an interior compartment communicating with said aperture and adapted for receiving a cylindrical medicine container, preferably a carpule, the container incorporating a piston and having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a first hollow needle,
- a piston rod displaceably arranged in said housing for displacing said piston from said distal end to said proximal end when said container is received in said compartment, and
- displacing means adapted for displacing said piston rod and comprising a battery powered actuator.

35. A dispensing device according to claim 34, wherein said housing adjacent said aperture is provided with first interconnecting means for interconnecting said hosing with second interconnecting means provided on a catheter assembly comprising:
- said first hollow needle adapted for being inserted into said closure body when said carpule is received in said compartment and said first and second interconnecting means are mutually engaged for interconnecting said housing and said catheter assembly such that said first hollow needle extends from a first end in the interior of said carpule through said closure body to a second end, and
- a catheter in fluid communication with said second end and for injection of said medicine into said user.

36. A dispensing device according to claim 34 o3 35, wherein said piston rod is provided with a longitudinally extending first screw thread on the outer surface thereof, and wherein said displacing means comprises:
- a toothed or ratchet wheel having a central aperture for receiving said piston rod and provided with a second screw thread meshing with said first screw thread such that rotation of said ratchet wheel in a first rotational direction will displace said piston towards said proximal end,
- a pivotable body, preferably a plate element, arranged pivotable around an axis adjacent said ratchet wheel and provided with a pawl for engaging the teeth of said ratchet wheel such that pivoting of said pivotable body in a second rotational direction rotates said ratchet wheel in said first rotational direction,
- a spring means adapted and arranged for applying a spring force to said pivotable body at a first point spaced from said axis for pivoting said pivotable body in said second rotational direction, and
- said battery powered actuator for rotating said pivotable body in a third rotational direction opposite said second rotational direction.

37. A dispensing device according any of the claims 34-36, wherein said actuator comprises a shape memory alloy wire.

38. A dispensing device according to any of the claim 34-37, wherein said actuator comprises a shape memory thread or wire fixedly attached at one end to an

electrically conducive fastening means and fixedly attached at the opposite end to said pivotable body at a second point spaced from said axis such that contraction of said shape memory wire pivots said pivotable body in said third rotational direction.

39. A dispensing device according to any of the claims 34-38, wherein said spring means comprises a rod spring extending generally parallel with said cylindrical medicine container and having one end fixated against lateral movement and the opposite end abuts, attached to or integral with said first point on said pivotable body.

40. A dispensing device according to any of the claims 34-39, wherein said piston rod is a flexible piston rod comprising a row of elements each having a top surface and a bottom surface as well as a lateral surface, the top surface of one element being connected to the bottom surface of the adjacent element by a hinge means located and adapted to allow the two adjacent elements to pivot from a first position where at least a portion of a top surface of one element abuts a corresponding portion of the bottom surface of the adjacent element, said first position corresponding to a rectilinear, relatively stiff configuration of the piston rod, to a second position wherein said top surface of one element is spaced from said bottom surface of the adjacent element corresponding to a curved configuration of said flexible piston rod.

41. A dispensing device according to claim 40, wherein said lateral surface has a first and a second mutually opposed circular cylindrical surface portions incorporating said first screw thread for meshing with said second screw thread.

42. A dispensing device according to claim 41, wherein at least one surface portion disposed between said first and second surface portion is plane so as to allow co-operation with means to prevent rotation of the piston rod around the longitudinal axis thereof when said first screw thread on the lateral surface of said elements is engaged by said second screw thread.

43. A dispensing device according to any of the claims 34-42, wherein said first point is located such relative to said axis and said spring force that the moment arm relative to said axis of said spring force increases as said pivotable body rotates in said second rotational direction.

44. A dispensing device according to any of the claims 34-43, wherein said second point is located such relative to said axis and said shape memory alloy wire force that the moment arm relative to said axis of the force exerted on said pivotable body by the contraction of said shape memory wire increases as said pivotable body rotates in said third rotational direction and/or said first point is located such relative to said axis and said spring force that the moment arm relative to said axis of said spring force increases as said pivotable body rotates in said second rotational direction.

45. A dispensing device according to any of the claims 34-44, wherein controlling means for controlling the operation of said actuator according to a programme are arranged in said housing.

46. A combination comprising:

- a disposable, wearable, self-contained medicine dispensing device according to any of the claims 35-45,

- a cylindrical medicine container, preferably a carpule, the container incorporating a piston and having an open distal end and a proximal end closed by a closure body made of a material, preferably silicone, that can be perforated by a first hollow needle, and

- a catheter assembly comprising:
  - said first hollow needle adapted for being inserted into said closure body when said carpule is received in said compartment and said first and second interconnecting means are mutually engaged for interconnecting said housing and

said catheter assembly such that said first hollow needle extends from a first end in the interior of said carpule through said closure body to a second end, and

- a catheter in fluid communication with said second end and for injection of said medicine into said user.

47. A combination according to claim 46, wherein said catheter assembly comprises:

- a second needle for perforating the skin of said user arranged displaceable along a linear trajectory generally orthogonal to the longitudinal extent of said first hollow needle,
- a plug of a perforatable material, preferably silicone, located on said trajectory and traversed by said first hollow needle,
- a compartment arranged adjacent said plug and receiving said second end of said hollow needle, and
- a guide body having an interior guide passage aligned with and in direct fluid communication with both the lumen of said catheter and said compartment and arranged such that said interior passage and said lumen is on said trajectory.

48. A combination according to claim 46 or 47, wherein said carpule is a standard carpule currently available from numerous suppliers.

49. A combination according to claim 46 or 47, wherein said carpule is provided with special geometrical features matching corresponding geometrical features of said housing and/or said catheter assembly such that lack of said special geometrical features on said carpule prevents the combination from being assembled to a form a viable medicine dispensing assembly.